

**SECRET**

CHAL - 1041

13 June 1960

**MEMORANDUM FOR THE RECORD**

**SUBJECT : Information on Soviet Surface-to-Air  
Missile and Associated Radars**

1. The Soviets have developed and apparently have in an operational state a new surface-to-air missile (SAM) system. This system is known as the SA-2. It has<sup>been</sup> estimated that the overall accuracy of the system operating against a B-52 flying at 45,000 feet is 115 feet circular probable error at the maximum intercept range of 25 miles. At the present time there are approximately 50 known SAM sites of this type, two of which are in East Germany. The SAM site configuration is circular and approximately 400 feet in diameter. Each site contains six revetted weapon emplacements, a centrally located fire control radar, and a nearby surveillance or acquisition radar.
2. The SA-2's missile, nicknamed Guideline, carries either a high explosive or nuclear warhead. The effective range of the missile is 25 - 40 miles to an altitude of 60,000 feet. It is believed however, that it has limited operational capability up to 80,000 feet.
3. Associated with the missile system are an acquisition radar, nicknamed Spoon Rest, and a tracking radar which is nicknamed Fruitset. Also associated with the system is an IFF set known as Score Board. The Spoon Rest Radar is capable of detecting a B-52 at maximum altitude at a distance of 110 nautical miles, which distance would be considerably less in the case of the CHALICE vehicle due to the smaller reflecting surface.
4. The Soviets have a new tracking or fire control radar, Fruit Set, for tracking the target aircraft and also for tracking the missile. This radar set consists of a van on which are mounted two parabolic antennas and two trough-like appearing antenna reflectors. The antennas appear to be capable of rotating 360 degrees in azimuth. The guidance system for the missile is believed to be of the command type. Located near the Fruit Set radar are a number of trailers which are interconnected by heavy cables. These trailers probably house the necessary computing equipment, power supplies, and communications gear. All six of the weapon emplacements are connected to the fire control station by cables.
5. The operational sequence of the SA-2 system is as follows:  
Target acquisition, target identification, target tracking, missile tracking, and radio commands to the missile. Initial acquisition of the target is accomplished by the Spoon Rest radar. Identification as either friend or foe is next accomplished by the Score Board IFF set. The Fruit Set radar then takes over. It begins to scan the target sector which is designated by Spoon Rest. When the target comes within detection range, the return from the target is presented in two displays, one being a range versus azimuth presentation, and the other being range versus elevation. Using joy stick controls the operator inserts range, azimuth, and elevation information into the tracking circuits.

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In this way an automatic tracking circuit is generated. The target is tracked by two trough-like appearing antennas. After tracking has been initiated, it is only necessary to observe the progress of the target. In case the track is broken by electronic jamming, use of chaff, or violent maneuvers, the operator must re-establish the automatic tracking mode. The exact use of the two circular antennas has not been definitely established. However, analysis indicates that the conventional appearing parabolic antenna, located on the extended arm, may be used for tracking a transponder in the missile. The transponder could be triggered by signals from the command link or by the side lobes of the track-while-scan radar until the missile comes within the main lobe of the radar antenna, at which time the signals from the track-while-scan radar could trigger the transponder. Information derived from this parabolic antenna could automatically position angle and range gates of the track while scan portion of the radar so that automatic tracking of the missile can begin as soon as the missile enters the track-while-scan sector. The parabola would then be free to guide another missile into the track-while-scan sector. The length of time required to guide a missile into the track-while-scan sector varies from 10 to 40 seconds, depending upon target altitude and range and the launching attitude of the missile. Two or three missiles could be guided to a target simultaneously. Information from the various tracking circuits is fed to a computer which automatically determines the required commands for the missile. They are then probably transmitted to the missile by a command link using the other circular antenna.

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- (a) All radars at the site, particularly those on the van located at the center of the site. Shown with the maximum amount of detail possible should be the wave guides, transmission lines, antenna feeds, antenna reflectors, mechanical drives for the antennas.
- (b) Any evidence of antennas or radomes on the missiles and any unusual missile configurations.

7. In addition to the above photographs, it is desired to secure the following by visual observation:

- (a) Operational characteristics of the radar, such as evidence of 360 degree rotation of the antennas, any pattern of motion of antennas, any coordinated or synchronized operation of two or more antennas.

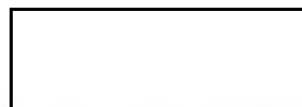
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8. Attached hereto is a conception of the appearance of the Fruit Set Radar.



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Development Branch  
DPD-DD/P

Attachment:  
As noted

DB/DPD-DD/P: 

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Distribution:

- Copy 1 - CH/DB/DPD w/att.
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